

# Effects of Neighborhood Poverty and Related Conditions on Birth Outcome: A Study of Medical, Behavioral and Neighborhood Risk Factors

Janice L. Hammond, Ph.D.  
Ph.D., Case Western Reserve University, 1998

## Statement of the Research Problem

Recent figures from the National Center for Health Statistics indicate that each year 11% of infants in this country are born too early and 7% are born too small (Ventura et al., 1997.) Based on the most recent information available, the United States ranked 21st among developed nations in low birthweight rates (Wegman, 1994). Although major improvements have occurred over the past few decades in the survival of preterm and low birthweight (LBW) infants through neonatal intensive care, similar improvements have not been observed in the incidence of LBW and prematurity. In fact, rates reached an all-time high in 1994 and 1995 with 7.3% of all births in the U.S. LBW, compared with 6.7% in 1984 (Ventura, 1997). LBW, with its major antecedent prematurity, is the major contributor to excessive infant death rates. It is also associated with increased short and long-term medical costs for surviving infants. For 1988 alone the excess dollar cost beyond those of a normal birth amounted to \$5.5- \$6 billion to provided health care, early intervention and special education to the nearly 4 million children 0-15 years of age who were born LBW (Lewit et al., 1995).

Poverty is one of the strongest predictors of LBW with poor neighborhoods generally having high rates of LBW. Yet, most infants born into poor families have normal birthweights and many neighborhoods that are poor show relatively low rates of LBW. Observation suggests that all poor neighborhoods are not alike. Wide differences exist among poor neighborhoods in their physical conditions, social institutions, family and age structure and networks of relationships (Coulton, Chow and Pandey, 1990). Poor neighborhoods differ on severity of poverty, racial and ethnic composition, and age and gender makeup of the population. Do these differences in conditions among neighborhoods affect birth outcome? Are there particular neighborhood characteristics that elevate an individual woman's risk of poor outcome? And how do environmental characteristics and individual characteristics work together to influence outcome?

## Background and Research Questions

An expansive literature base exists on the effect of medical and demographic risk factors on LBW and premature births. Although these personal risks are not the focus of this study, it is important to understand their influence to identify potential confounders that should be controlled in the model. Low socioeconomic status, previous preterm birth, cigarette smoking, prior spontaneous abortion, and in utero exposure to DES are well-

established risk factors and cocaine use in pregnancy, cervical and uterine abnormalities, and genital tract infections are probable causes.

Touching on a few of these risks, socioeconomic status (SES) has consistently been associated with poor birth outcome. Disadvantaged individuals experience elevated morbidity and mortality with nearly every physical and psychological health outcome, including low birthweight, premature delivery and infant mortality. Race has also traditionally been linked with pregnancy outcome with African-Americans at elevated risk for preterm and LBW births. It should be noted that the dynamics of the relationship between race and birth outcome are not clearly understood and some espouse that if you adequately control for SES differences, the importance of race disappears. Third, prenatal care has conventionally been viewed as protective against bad pregnancy outcomes. However, recent findings are showing it does not prevent preterm birth and has only a small effect on LBW. New information is suggesting a link with episodic illness and general morbidity during pregnancy, including gingivitis or gum disease. For further details, two excellent, comprehensive reviews of personal risk factors have been done by M.S. Kramer (1987) and by Gertrud Berkowitz and Emile Papiernick (1993).

Nearly all of the existing research on birth outcomes has focused on causes at the individual and family level. Unfortunately, these demographic and medical risk factors have not proven to be very strong predictors of LBW births, particularly preterm-LBW births. The known risk factors jointly account for less than 25% of babies born too early and too small (Shiono and Behrman, 1995). Given the lack of explanation with traditional individual determinants, some of the leading experts in the field have called for a broader investigative approach which includes the study of environmental influences (Kliegman, Rottman and Behrman, 1990). This coincides with growing attention over the past few years to the important effect factors outside the individual and immediate family have on health and disease, potential influences which have generally been overlooked. As Brooks-Gunn et al. (1993) note, one must not lose sight of the fact that individuals do not operate in isolation but rather exist within the context of an environment and operate within multiple ecological systems.

While there have been a number of neighborhood studies demonstrating that LBW is concentrated in certain neighborhoods, only handful of researchers have conducted contextual studies which explore the impact of community on LBW outcomes at the individual level while controlling for personal risk factors. Three studies addressing this have been conducted in Chicago. First, a multi-level study of the impact of neighborhood economic status on LBW was done by David and Collins (1990). A second study by Collins and Shay examined the relationship of place of residence and maternal nativity to LBW among Hispanic women (1994). A third investigation in 1997 by Eric Roberts' 1997 looked at the impact of neighborhood quality, economic hardship, stability, racial composition, and percent young and old on LBW. A fourth study was carried out in Baltimore by O'Campo et al., looking at main effects and interaction effects of neighborhood and individual risk factors on LBW (1997). And, finally, a study of the impact of neighborhood political violence on pregnancy complications and outcomes in Chile was undertaken by Zapata et al., (1992). All of these studies demonstrated main

effects of neighborhood conditions on LBW and O'Campo found significant interaction effects with prenatal care proving less protective in neighborhoods with higher levels of unemployment and low average wealth.

The current study utilizes a multi-level approach, linking individual-level and macro-level predictors, to investigate neighborhood conditions which may predispose women to deliver preterm-LBW infants. It is based in an ecological framework as well as prior research at the Center on Urban Poverty and Social Change, studies on neighborhood influence, and the extensive literature base on medical, behavioral and demographic risk factors. Of interest is whether neighborhood factors such as impoverishment, age and gender structure, instability, residence adjacent to a high poverty area, and drug crime rates contribute to an individual's risk of poor birth outcome. It evaluates the combined effects of these neighborhood characteristics while taking into account traditional demographic and biomedical risk factors. Nonadditive effects between neighborhood and individual-level variables are also explored.

Research questions this study seeks to answer:

1. What neighborhood characteristics raise or lower the chances that a woman will deliver a preterm-LBW infant?
2. Do neighborhood effects persist when individual socioeconomic, medical care, and medical risk factors are taken into account?
3. Is there evidence that individual factors moderate the relationship between neighborhood effects and birth outcome?

It was anticipated that adverse neighborhood conditions in combination with known medical and demographic risk factors will increase a woman's chance of having a preterm-LBW baby.

### Methodology

The study focuses on birth outcomes in Cleveland, Ohio with all births occurring in the city from 1989-1991 included in the data set. Cleaning procedures and missing data eliminated about five thousand observations, giving a final N of 26,340 cases. The study utilizes three secondary data sources: vital records from the Ohio Department of Health, 1990 census data, and 1990 crime data from the Cleveland Police Department. Characteristics of the neighborhood were obtained from the census and police data and appended to each birth record, so that for each mother there was personal information about her health, behavior and demographic characteristics as well as information about the neighborhood in which she lived (i.e. drug arrest per 1,000 residents).

*Neighborhood Variables.* In that prior work showed that many of the neighborhood variables were highly inter-correlated, they were grouped into a smaller number of underlying dimensions using principal components method with varimax

(orthogonal) rotation. Three factors emerged from this process: impoverishment, instability, and gender and age structure. Variables that loaded on impoverishment included: poverty rate, unemployment rate, vacant housing, population loss, neighborhood education level, family headship, percent black, and violent crime rate. Neighborhood impoverishment represents differences among neighborhoods in terms of economic resources, disadvantage, and disinvestment, restricted employment and economic opportunities, and residential segregation. The second factor, instability, represents population movement, measured by tenure <10 years, percent of the tract that moved between 1989-90, and the percent that moved in the previous 5 years (1985-90). Age and gender structure, the third factor, is seen to represent human or social resources in the community. It is measured through the ratio of children to adults, ratio of males to females and percent of the population that is elderly. Two additional variables were added to capture other neighborhood dimensions, contiguous to a surrounding tract with high poverty rates and rate of drug arrests. The first is included to represent geographic and economic isolation and the latter represents drug trafficking and neighborhood danger.

*Individual-Level Variables.* Individual-level predictors were incorporated as control variables and to explore how they might moderate neighborhood effects. Included were adequate prenatal care (based on the Kessner Index), low maternal education, maternal age, maternal race/ethnicity, marital status, alcohol use in pregnancy, tobacco use in pregnancy, and medical risk factors. The outcome variable, preterm-LBW, was defined as having an infant born prior to term (37 weeks gestation) and weighing less than 2,500 grams (5-1/2 pounds).

*Data Analysis.* Following data cleaning procedures, univariate distributions of all continuous variables were examined for means, ranges and normalcy. In that all of the individual-level variables were dichotomous, distribution of values were reviewed. Additionally, some general analyses were run on the data set. These preliminary analyses showed that 53% of the study births were to nonHispanic blacks, 41% to nonHispanic whites, 5% to Hispanics, and 1% to other nonHispanics. Seven percent of the Cleveland births were identified as preterm-LBW. Additionally, in keeping with national rates, the African-American preterm-LBW rate in Cleveland was double that of whites and Hispanics (9.5% compared with 4.1% and 4.6%, respectively) and rates were lowest for the Asians (2.7%).

Bivariate analyses were then performed to identify neighborhood variables associated with preterm-LBW rates for each tract. Zero-order correlations were found to be significant at the .05 level for all five neighborhood factors and variables with preterm-LBW, suggesting all should be retained for future analyses. In that impoverishment was anticipated to be one of the most important neighborhood variables, neighborhoods were classified as high (> 1 standard deviation above the mean), low (< 1 standard deviation below the mean) and medium impoverishment (within one standard deviation above and below the mean) and preterm-LBW rates were compared for each neighborhood type. Findings indicated that prior to controlling for other variables, the rate of preterm-LBW

births for women in the high impoverishment areas was 10.9%--3 times that of women living in the low impoverishment neighborhoods (3.6%). Inter-correlations among neighborhood variables and with individual-level variables were also examined for problems with multi-collinearity. Cross tabulations were used with pairs having dichotomous outcomes. This was followed by multivariate analyses. Logistic regression was used in that the outcome was binary--whether the woman had a preterm-LBW or normal outcome.

## Results

To answer the first research question, "What neighborhood characteristics raise or lower the chances that a woman will deliver a preterm-LBW infant?", only neighborhood variables were entered into the model. All of the neighborhood indicators except Rate of Drug Arrests were found to be significant predictors of preterm-LBW ( $p < .05$ ). To address research question two, "Do neighborhood effects persist when individual socioeconomic, medical care, and medical risk factors are taken into account?", individual risk factors were added to the model. It was found that after controlling for individual-level risks, none of the neighborhood variables retained significance. However, all of the individual predictors were significantly related to preterm-LBW.

Next, analyses were undertaken to address research question three, "Is there evidence that individual factors moderate the relationship between neighborhood effects and birth outcome?" Two interaction terms were added to the comprehensive model: Impoverishment\*NonHispanic Black and Impoverishment\*Medical Risk Factors. With the addition of the interaction terms, the main effect of neighborhood impoverishment again became significant ( $p < .05$ ). Additionally, all of the individual-level predictors except maternal education (which was borderline) remained significant and one of the two interaction terms (impoverishment\*medical risk) proved significant. Given the lack of significance of the other four neighborhood variables, a more parsimonious model was tested which included neighborhood impoverishment, all of the personal predictors, and the same two interaction terms.

In the reduced model, all of the main effects were significant along with the two interaction effects. The results show that for each one unit increase in impoverishment, the risk of having a preterm-LBW baby increases by a factor of 1.19. Additionally, women with one or more medical risk factors are 2.54 times more likely to have a bad outcome than someone with no medical risks. Those who used alcohol in pregnancy were nearly 2 times more prone to an early, underweight baby. Tobacco use also was found to place smokers at 1.8 greater risk than nonsmokers and nonHispanic blacks were at 1.67 greater risk than nonblacks. Furthermore, receiving adequate care, being married, and mother's age between 17-34 were found to be protective factors, lowering risk of a bad outcome.

The two interaction effects were graphed to enhance interpretation. In terms of medical risk factors modifying the effect of impoverishment on preterm-LBW, the graph

demonstrates that for women with medical risk factors present, impoverishment has no effect on outcome. However, for women with no medical risk factors, impoverishment does make a difference with risk increasing as impoverishment worsens. In fact, for those without medical risks living in the worst neighborhoods, chances of having a preterm-LBW baby approach those of the higher-risk women with pregnancy-related medical risks.

A person's race was also found to modify the importance of neighborhood impoverishment. Graphing clarified that although blacks are at higher risk, neighborhood impoverishment does not appear as much of a marker for distress for this group. That is, bad neighborhoods do not increase the risk of a bad birth outcome for blacks. For nonblacks, however, neighborhood impoverishment does raise one's risk, so that in the worst neighborhoods these women have a greater chance of having a preterm-LBW baby than black women in similar neighborhoods. These findings are consistent with two other studies by David and Collins (1990) and by Kleinman and Kessel (1987) who found the absence of a low risk group among African-Americans.

### Discussion and Utility for Social Work Practice

The findings illuminate the importance of a multi-level approach research, linking micro and macro determinants of health to gain a more complete understanding of health outcomes. In terms of social work practice, the results support an ecologic model of human development which takes into account the importance of community influences. This perspective emphasizes that individual organisms function within the context of an environment with environmental influences such as neighborhood impoverishment impacting on health and well-being.

An interesting finding, requiring further research to better understand the implications, is that the effect of neighborhood impoverishment varied for different racial/ethnic groups. The findings suggest that neighborhood improvement alone is not the answer to improving birth outcomes for minorities and thereby reducing the racial disparity in rates. Policies and programs aimed solely at restoring bad neighborhoods or dispersing individuals to better neighborhoods will more than likely not have the desired results unless they are coupled with other interventions.

There are several possible explanations for the apparent unimportance of residential impoverishment for blacks. First, it could be that various community resources modify its effect. Although the present study did not include measures of services, institutions and social capital in communities, prior work has shown that some black communities in Cleveland that are highly impoverished have high levels of these resources which may offset the effect of impoverishment. This may be due to targeted initiatives and/or talented community residents and leaders. These resources may exist to a higher degree or operate more effectively in the most distressed black neighborhoods. On the other hand, whites living in the highest impoverished areas are in minority and are cut-off from participation in the beneficial community resources. Although it is not uncommon for

blacks to live in the worst, impoverished area, few whites live in these extremely poor areas (Mayer and Jencks, 1989; Collins and David, 1990). A selection effect may also be operative. There may be something unique about their situations or other pre-existing risk factors which draw these whites to reside in the extreme neighborhoods. A third explanation for the results is that the nonHispanic blacks in this study have a higher level of other predisposing risks, unmeasured in this study, which play a more important, overriding role than neighborhood impoverishment in affecting outcomes. Examples of this include urinary tract infections or sexually and nonsexually transmitted diseases to which recent studies are pointing (Schoendorf, *et al.*, 1992), gingivitis or personal drug use during pregnancy. Blacks have been found to have rates of syphilis ten times higher, gonorrhea five times higher, as well as elevated rates of chlamydia, bacterial vaginosis and other infectious agents. Perhaps in the absence of these stronger factors, impoverishment is important. Such critical unknown causal factors need to be identified. Finally, the findings may reflect a restricted range of neighborhoods, particularly for African-Americans, in that the study was limited to the City of Cleveland. The author has been working to extend this study to determine if findings hold when Cleveland suburbs with better-off black neighborhoods are included. Preliminary results using the entire county do not differ from the Cleveland study, however, suggesting that restricted range is not a plausible explanation.

In terms of impoverishment only having detrimental effects in the absence of medical risks, although adequacy of care is being controlled for and should therefore not be the explanation, it may be that the quality of care differs for women deemed at high-risk due to medical conditions. They may be referred to specialty care, be followed more closely or receive additionally social support than women not identified with problems, overriding the effect of the bad living environment. On the other hand, women with no identified medical problems may get routine care and no special supports so that impoverishment does take its toll. This relationship should be examined more carefully in future studies to better understand the dynamics.

It was surprising that drug arrest rates did not prove to be important in any of the regressions, even prior to controlling for personal risks. It would be useful to further explore why this is so, since intuitively one would expect dangerous environments to be detrimental. Conceptually, it had been anticipated that drug trafficking (using drug arrests as a proxy) was reflective of dangerous environments which in turn would affect pregnancy via stress and anxiety. The lack of influence of this neighborhood variable may be simply that dangerous environments, represented by drug arrests, don't impact birth outcome or do not cause stress and anxiety. Alternatively, it may relate to difficulties operationalizing the construct of dangerous environment or may reflect measurement problems. In that the indicator "drug arrests" are based on police reports, arrests may differ among neighborhoods based on how aggressively a particular district pursues this crime, the expertise of its officers, and time availability to pursue drug traffickers, rather than actual drug trafficking. Alternative methods of measuring the construct of neighborhood danger and resulting anxiety, such as directly assessing residents' perception

of danger and drug availability in their community, may provide better results than the indicator of drug arrests rates.

Several study limitations should be considered prior to drawing conclusions or attempting to make policy or practice implications from these findings. This study should be viewed as a starting point in a largely unexplored area. Further refinements and follow up studies are needed before definitive conclusions can be drawn. It should be noted that it is not possible to prove causation with cross-sectional designs. Also, it is conceivable that another variable not in the study is responsible for the apparent importance of neighborhood. Variables available for inclusion in the model were restricted by the use of secondary data sources. An additional shortcoming is that neighborhood residence is limited to one point in time--delivery.

Therefore, it is not possible to account for longevity in a given community and length of exposure to its influences. Additionally, one cannot rule out that people may self-select into a given neighborhood such as drug users choosing to move into a community with high levels of drug trafficking. In this scenario although neighborhood may appear influential, it may really be personal factors such as drug use that influence the birth outcome. Another potential weakness is that neighborhood may be incorrectly defined and measured as census tracts, resulting in underestimation of their effect. Another consideration is that follow up analyses suggested that some of the neighborhood effects may be operating through individual-level factors such as prenatal care and medical risk factors. If this is the case, the inclusion of mediating individual predictors may be adjusting away neighborhood effects. Different statistical methods such as path analysis or LISREL would be needed to test if the individual factors are endogenous. Finally, there was some suggestion from tolerance statistics that multicollinearity may be affecting the results, making it difficult to separate neighborhood and individual effects such as race and impoverishment. This is related to the extreme segregation in Cleveland and the close association between race and residential poverty. To remedy this the study would need to be undertaken in a less racially segregated city.

In closing, the results of this study suggest that neighborhood effects should not be ignored. Again, this is a starting point for future multi-level studies of birth outcome. Given the racial disparity in outcomes and apparent unimportance of neighborhood impoverishment for nonHispanic blacks, a critical direction for future research is to identify the central factors placing blacks at greater risk. Research should also be directed at better understanding the dynamics between impoverishment and medical risk status.



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